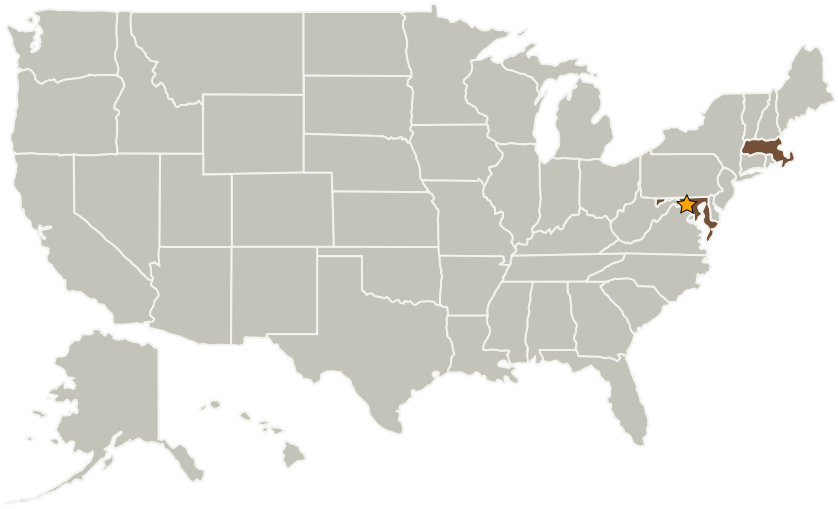
Modified Collins Cryocooler for Cryo-Propellant Thermal Management, Phase I

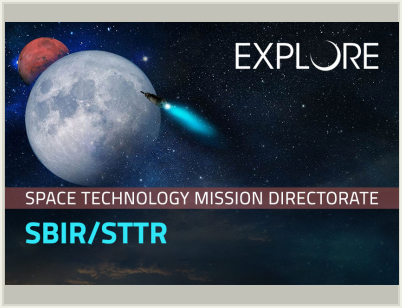
Completed Technology Project (2008 - 2009)

Project Introduction

Future lunar and planetary explorations will require the storage of cryogenic propellants, particularly liquid oxygen (LOX) and liquid hydrogen (LH2), in low earth orbit (LEO) for periods of time ranging from days to months, and possibly longer. LEO is a relatively warm thermal environment and without careful thermal management, significant quantities of stored liquid cryogens can be lost due to boil-off. This requires that larger volumes of cryogenic fuels must be launched into orbit so that sufficient quantities are available to satisfy the mission propulsion requirements. It has been shown that active cooling using space cryocoolers has the potential to result in Zero Boil-Off (ZBO) of stored cryogens. The launch-mass savings using active cooling exceeds that of passive cooling of LOX for mission durations in LEO of less than 1 week. The savings advantage of active cooling for LH2 begins after about 2 months in LEO. The proposer is developing a Modified Collins Cryocooler that offers the potential for higher efficiency cooling with better system integration for ZBO storage than can be provided by Stirling or pulse-tube type cryocoolers.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Advanced Mechanical Technology, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Watertown, Massachusetts

Primary U.S. Work Locations	
Maryland	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Charles Hannon

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.1 In-space Propellant Storage & Utilization